



ASSESSMENT TASK

The water front bench

Subject: Y10 Extended
Mathematics

Name Justin Tang
(Class): Y10T(22)

Topic: Polynomials

Reading material: Chapter 2 & 6 in Book A

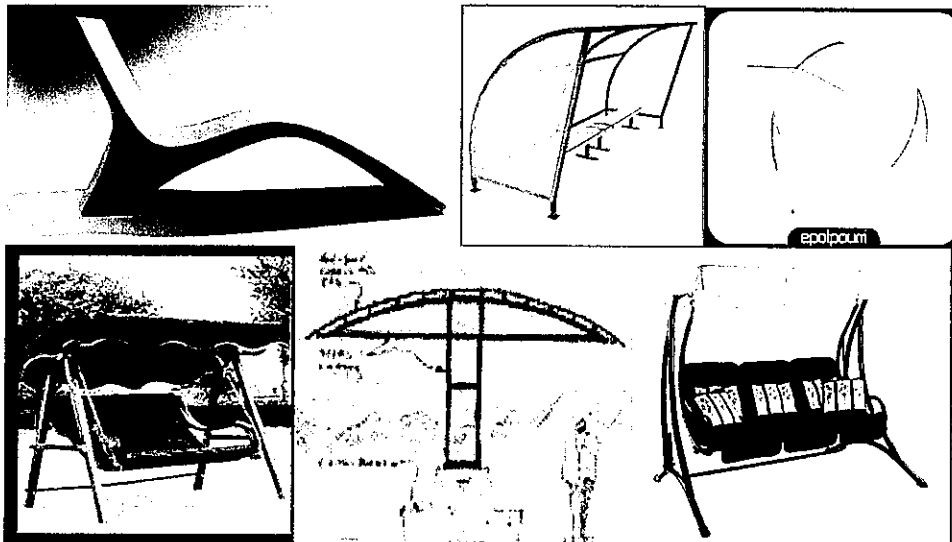
Date of task assigned: 22nd September, 2011

Due Date: 6th October, 2011

Submission of task: Please submit a print copy of the assessment to your Maths teacher on or before Thursday, 6th October 2011 at 0840.

This task assesses Criteria A, C, & D.

Task Brief: Design a water front bench with a canopy.



Canopy ->

Seat->

ADVICE:

Read the criteria descriptors and task-specific rubrics carefully before you start your work. This will give you a clear understanding of what is required and what a high quality piece of work for this task must include.

This way you give yourself the best chance of achieving the highest levels in this task.

Please attach these sheets to your final report.

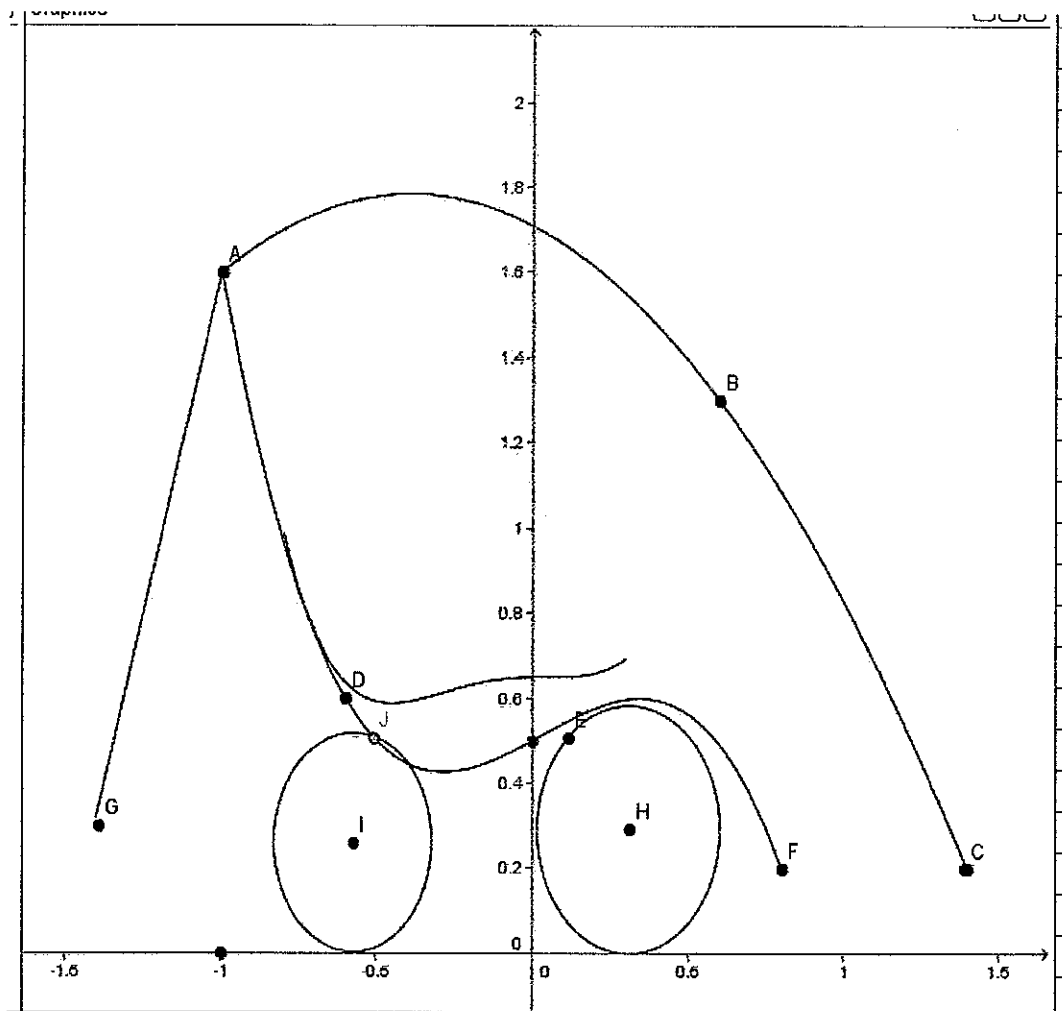
Assessment Criteria for Y10 Extended Maths Bench Assessment

Criterion A		
Levels	Task-Specific Rubric	Official IB Descriptors
0	The student does not reach a standard described by any of the descriptors given below.	
1-2	The student generally makes appropriate selections of one or more simple functions (such as $y=mx+b$, $y=x^2$) and manipulates them in to form a chair/bench.	The student generally makes appropriate deductions when solving simple problems in familiar contexts.
3-4	The student generally makes appropriate selections of two or more non-linear functions (eg quadratics or cubics) and manipulates them to form a chair/bench with a canopy.	The student generally makes appropriate deductions when solving more complex problems in familiar contexts.
5-6	The student generally makes appropriate and accurate selections of three or more sophisticated functions (eg higher order polynomials, trigonometric functions) and manipulates them to form a chair/bench with a canopy.	The student generally makes appropriate deductions when solving challenging problems in a variety of familiar contexts.
7-8	The student consistently makes appropriate and accurate selections of four or more sophisticated (eg higher order polynomials or trig) functions and at least one unfamiliar one (eg circles, roots, exponentials, logs, hyperbolas etc) to form a chair/bench with a canopy.	The student consistently makes appropriate deductions when solving challenging problems in a variety of contexts including unfamiliar situations.

Criterion C		
Levels	Task-Specific Rubric	Official IB Descriptors
0	The student does not reach a standard described by any of the descriptors given below.	
1-2	Some very basic equations are offered and described. There are some appropriate diagrams and graphs. There is a basic narrative that describes the processes used.	The student shows basic use of mathematical language and/or forms of mathematical representation. The lines of reasoning are difficult to follow .
3-4	Equations used are generally clearly explained. Clear, accurate and relevant graphs, and/or charts and tables are provided. It is generally easy to see how these diagrams describe the development of the chair/bench design. Key vocabulary is used. Narrative is generally accurate.	The student shows sufficient use of mathematical language and forms of mathematical representation. The lines of reasoning are clear though not always logical or complete . The student moves between different forms of representation with some success .
5-6	Several graphs and diagrams are offered to show the development of the chair/bench. Graphs are accurate and detailed. Equations are provided which match the important features of the graphs. It would be possible for PSC engineers to produce the chair/bench from the diagrams. The narrative is very clear.	The student shows good use of mathematical language and forms of mathematical representation. The lines of reasoning are concise, logical and complete . The student moves effectively between different forms of representation.

Criterion D		
Levels	Task-Specific Rubric	Official IB Descriptors
0	The student does not reach a standard described by any of the descriptors given below.	
1-2	There has been a limited amount of relevant research undertaken. To some degree, the student has connected this research to the design of the chair/bench.	The student attempts to explain whether his/her results make sense in the context of the problem. The student attempts to describe the importance of his or her findings in connection to real life where appropriate.
3-4	The student has undertaken good, relevant research and has used this in the development of the chair/bench. The student has explained with justification how the design features of the chair/bench relate to real-life issues. The student tries to explain the accuracy of the equations.	The student correctly but briefly explains whether his/her results make sense in the context of the problem. The student describes the importance of his/her findings in connection to real life where appropriate. The student attempts to justify the degree of accuracy of his/her results where appropriate.
5-6	The student critically compares the final product with features identified at the design stage. Real-life issues associated with the design are developed. The student justifies appropriateness and accuracy of all equations and offers a critical review of the mathematical methods used, suggesting viable alternatives or improvements where appropriate.	The student critically explains whether his or her results make sense in the context of the problem. The student provides a detailed explanation of the importance of his/her findings in connection to real life where appropriate. The student justifies the degree of accuracy of his/her results where appropriate. The student suggests improvements to his/her method when necessary.

The Waterfront Bench Design



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Introduction

I have been hired as a new designer at the Polynomial Seating Company (PSC). The PSC is world famous for designing and manufacturing creative and attractive seats and benches, mainly for outdoor uses. I had been given a special task of designing a chair or bench for outdoors. I am not going to build the bench but I will come up with the functions (equation) that will define the shape of the bench. I will submit a report that outlines the development of my design. My report will be assessed using MYP assessment Criteria A, C and D. Which Criterion A assesses knowledge and understanding, C assesses mathematical language and communication and D assesses explanation and reflection.

My design will be concerned in these aspects -

- The length of the leg of the chair (height between the seat and the ground)
- The height of the back of the chair
- The angle between the back of the chair and the seat
- The length of the sitting area (seat)
- The shape of the canopy
- The length of the armrest

Research

In order to have a good research on my assessment, I developed few guiding question to guide me through the project -

1. What is a chair?
2. How can chair help us?
3. What are the different types of chair?
4. What is the use of a canopy when it is added above a chair or a bench?
5. How people sit or lounge?

Research-

What is a chair?

A chair is a stable, raised surface used to sit on, commonly for use by one person. Chairs are most often supported by four legs and have a back. Chairs can be in many different shapes. When a person tries to relax, a chair is a best thing to rely on.

How can chair help us?

Chair can help us a lot, it can help us to sit in a better posture, and it makes us feel very comfortable. A chair can be used in any time, when you're tired, you can sit on it and it won't be damaged so easily.

What are the different types of chair?

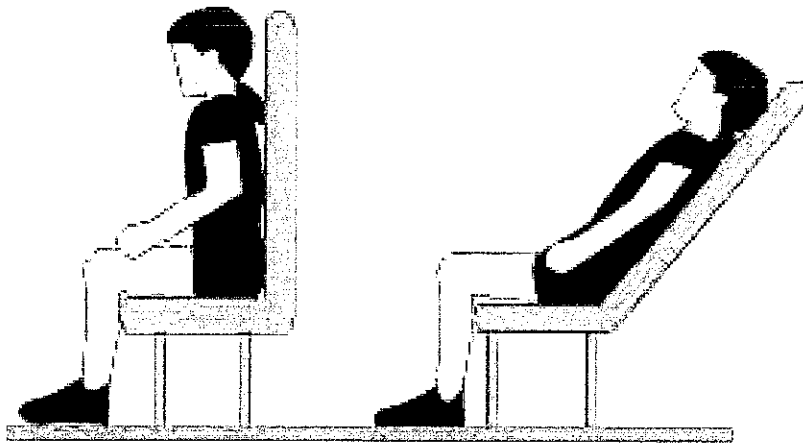
There are many different types, different colors and different shape chairs. Different types of chair include wing chair, club chair, arm chair, beach chair and car chair etc. Different types of chairs apply in different thing.

What is the use of a canopy when it is added above a chair or a bench?
Canopy is added above a chair or a bench as a protection from the sun and light rain. The canopy is use all over the world.

How people sit or lounge?

Sitting is a rest position supported by the buttocks or thighs where the torso is more or less upright. There are many types of ways to sit such as Sitting on the floor, Parallel legs, Cross-legged and sitting on a raised seat.

Different postures -



Left: Traditional 90-Degree Sitting Position

Right: 135-Degree Sitting Position

Sitting upright for hours causes increased stress on the back, and may be a cause of chronic back problems. These two are the most traditional sitting positions which will not hurt our body.

Survey

1. What is your gender?

☐ Male

☐ Female

2. How old are you?

☐ 0-5

☐ 5-10

☐ 10-15

☐ 15-20

☐ other

3. What is your height?



4. What materials do you prefer to make a chair?

☐ metal

☐ plastic

☐ steel

☐ iron

☐ other

5. Your height between waist and foot



6. Your height between head and waist

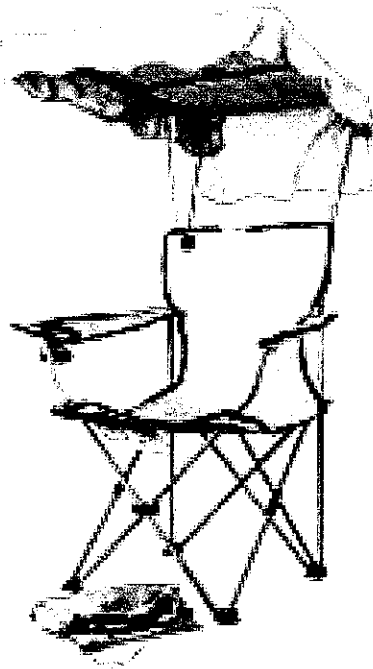


Specifications of my design

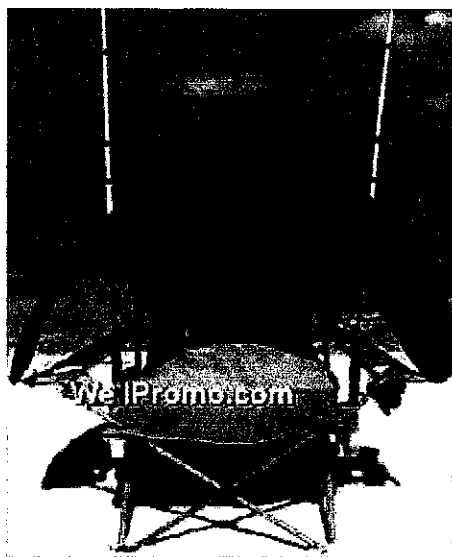
Aspects	Design	Reasons
Shape of canopy	Parabolic shape	The shape of canopy should be in a parabolic shape, it can let the raindrops slide onto the ground other than standing on the canopy when the raindrops hit the canopy
Shape of the armrest	Quartic shape	No special reasons for the shape of the armrest. I just follow the design of the armrest of my lab chair
Length of the armrest	60cm	I just followed the chair of my room because it's armrest is comfortable
Shape of the seat	Wavy shape	No special reasons, I think any shape of the seat is better than having a flat surface of a seat
Size of the sitting area	40cmx 40cm	For chairs, most of the sitting area is between this size, my lab chair either. I felt natural and very comfortable sitting on it

Height of the back of the chair	110cm	I think that 110cm is the best fit of the height of the back of the chair. Since I want my chair to be able to lay back
Distance between the seat and the ground	50cm	The distance between the seat and the ground is where the distance our foot and our seat. If its more than 50cm, it will be very uncomfortable for a taller person to sit on
Shape of the chair wheel	circle	It will be able to be moved if the wheel of the chair is in a shape of circle
Target User	Anyone	My chair is targeted for everyone because it will be useful and comfortable for everyone

Analyzing the chairs with canopy in mood board-



This is a chair with a plastic canopy, this chair better be used beside the beach or the swimming pool. This chair may be too small for an adult to sit on, there is an armrest and a big enough canopy, only disadvantage is that the chair may not be comfortable.



This is a chair with a plastic canopy, according in the photo, it is beside a beach, the canopy is very big so it can be a very good protection from sun light and light rain. The chair may be too short for a tall person to sit on, the length between two armrests may be too long so it will let people fill uncomfortable.

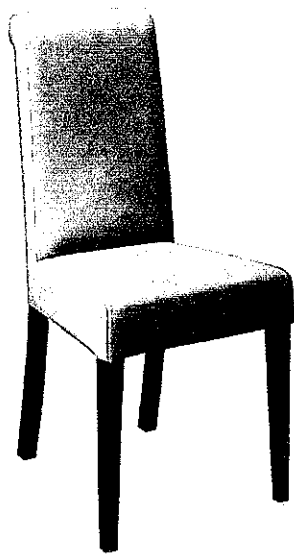
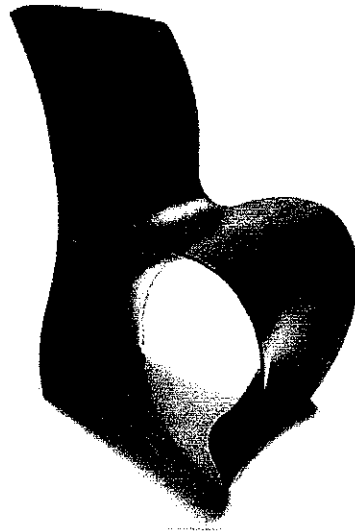


This is a chair with a plastic canopy, it is a very big canopy so it can be a good protection from sun light and light rain. The back area might too small for a person to sit on, other than this; this is a very good chair with a canopy.

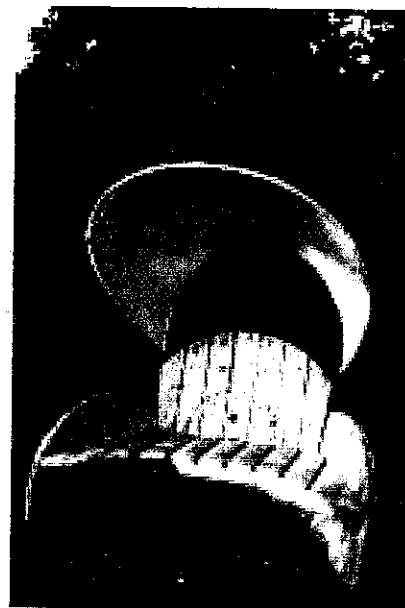
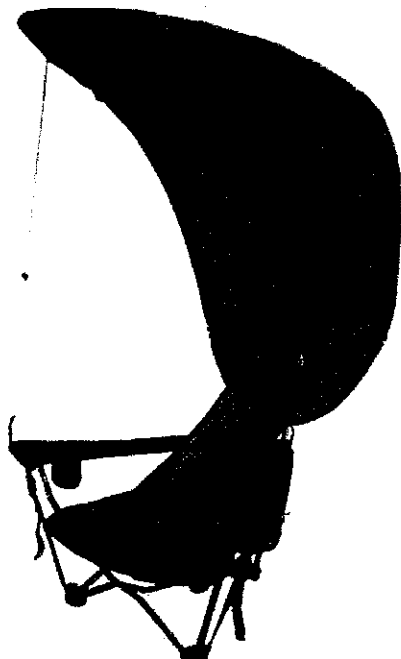
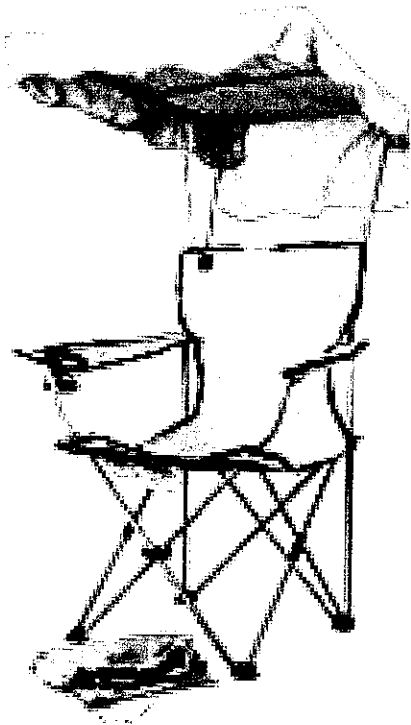


This is a bench with a wooden canopy; this bench might be very comfortable because the sitting area is big enough. This bench is made of wood so it might get damage by certain amount of raining. If there is an armrest, it will be much better instead of sitting there.

Mood Board - Chair without a canopy



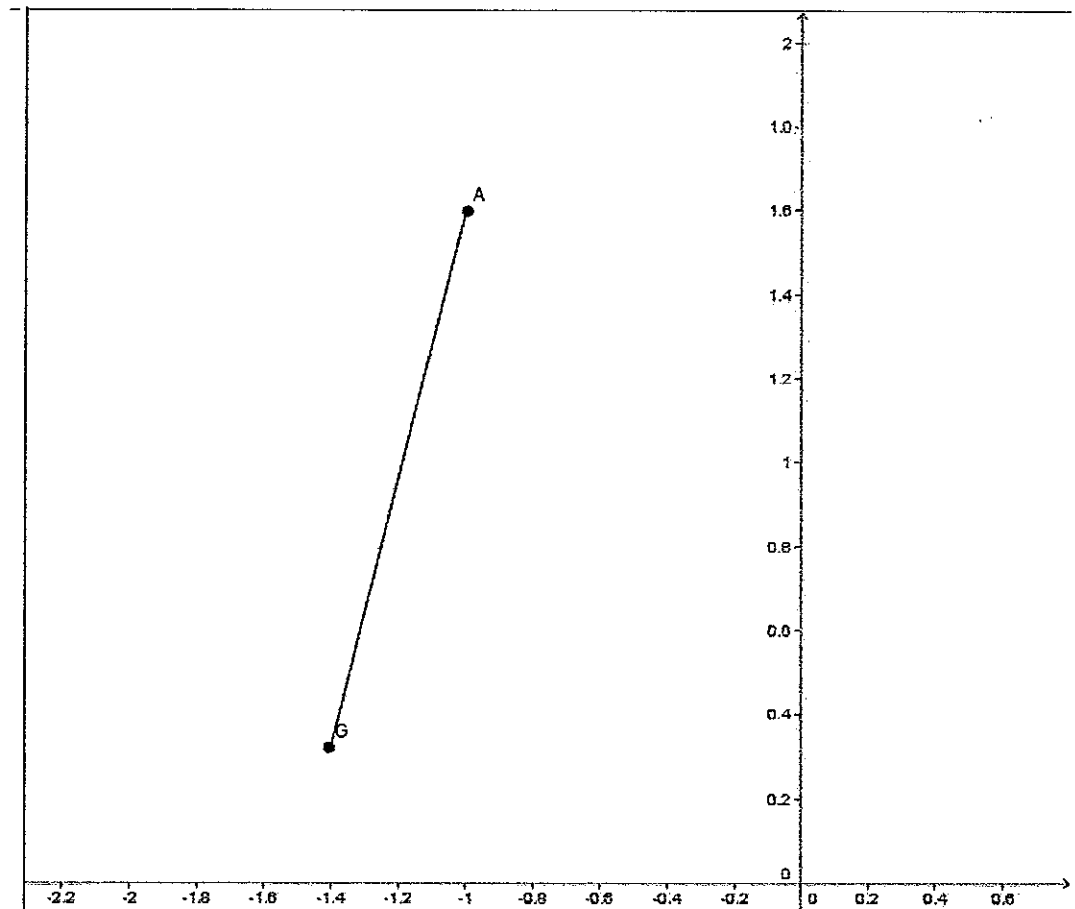
Chair with a canopy -



Equations

There are a total of four lines and two unfamiliar situations, one linear line, one quadratic line, one cubic line and one quartic line. I have decided each unit of the coordinate (0.1) represents 0.1metres or 10centimetres.

Linear Equation (slope)-AG



I am given that the information that A (-1, 1.6), G (-1.4, 0.3)

I find the slope of AG using the formula that I learnt before -

$$\frac{y^2 - y^1}{x^2 - x^1}$$

This linear line is the support (back pole) of the back of the chair, it is used to balance the heavy canopy, prevents from collapses.

Slope of AG -

A (-1, 1.6), G (-1.4, 0.3)

Apply it in the formula - $y^2 - y^1 / x^2 - x^1$.

$$\text{Slope of AD} = \frac{0.3 - 1.6}{-1.4 - (-1)}$$

$$\text{Slope of AD} = \frac{-1.3}{-0.4}$$

$$\text{Slope of AD} = \frac{0.3 - 1.6}{-1.4 - (-1)}$$

$$\text{Slope of AD} = \frac{-1.3}{-0.4}$$

$$\text{Slope of AD} = \frac{-1.3(10)}{-0.4(10)}$$

$$\text{Slope of AD} = \frac{-13}{-4}$$

$$\text{Slope of AD} = \frac{13}{4}$$

After obtaining the slope of AD, I can now form the slope intercept form.

Slope intercept form of AG

$$A (-1, 1.6), G (-1.4, 0.3)$$

$$\text{Slope of AD} = \frac{13}{4}$$

$$\text{Slope intercept form of AG: } y = \frac{13}{4}x + b$$

To find B, I put A (-1, 1.6) in the following equation

$$y = \frac{13}{4}x + b$$

$$1.6 = \frac{13}{4}(-1) + b$$

$$1.6 = -\frac{13}{4} + b$$

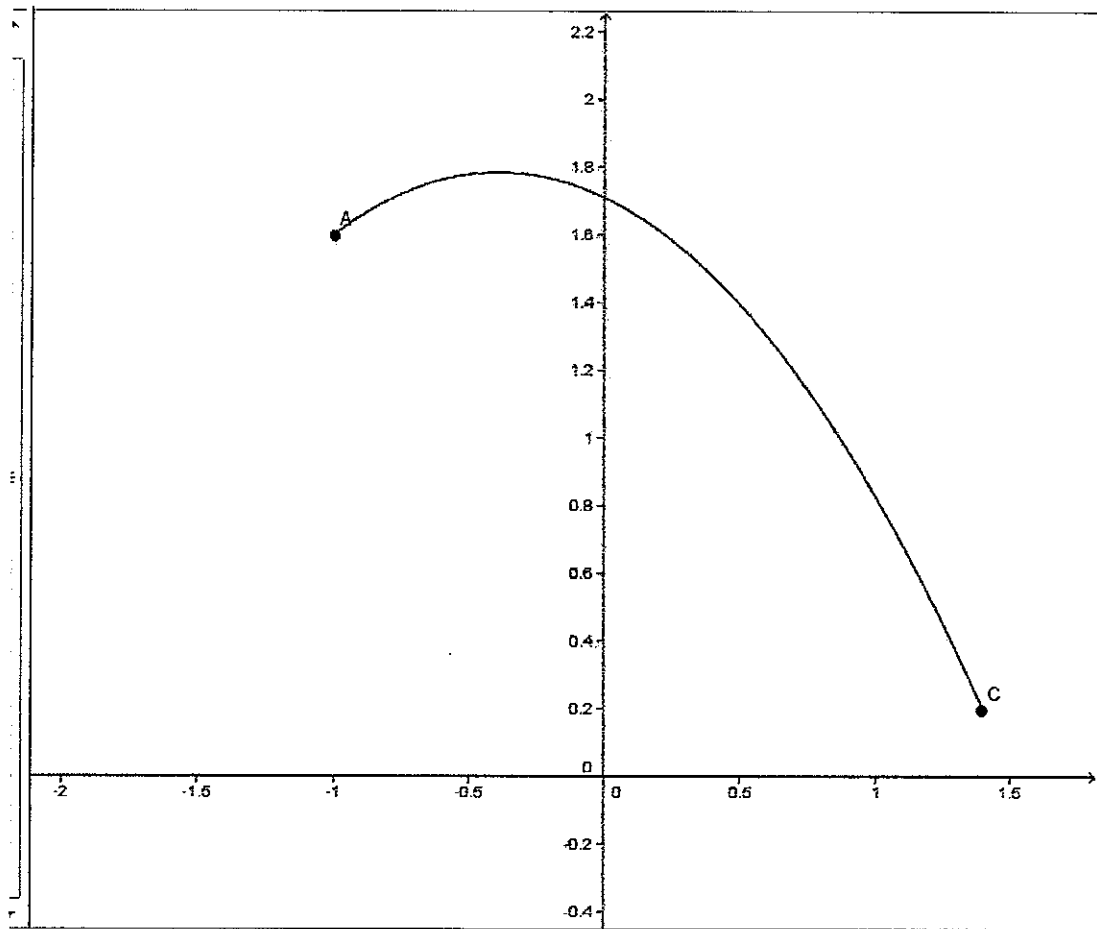
$$\frac{13}{4} + 1.6 = b$$

$$b = 4.85$$

Since $b = 4.85$, the slope intercept form of straight line AG is

$$y = \frac{13}{4}x + 4.85$$

Quadratic equation of quadratic line AC (Chair canopy)

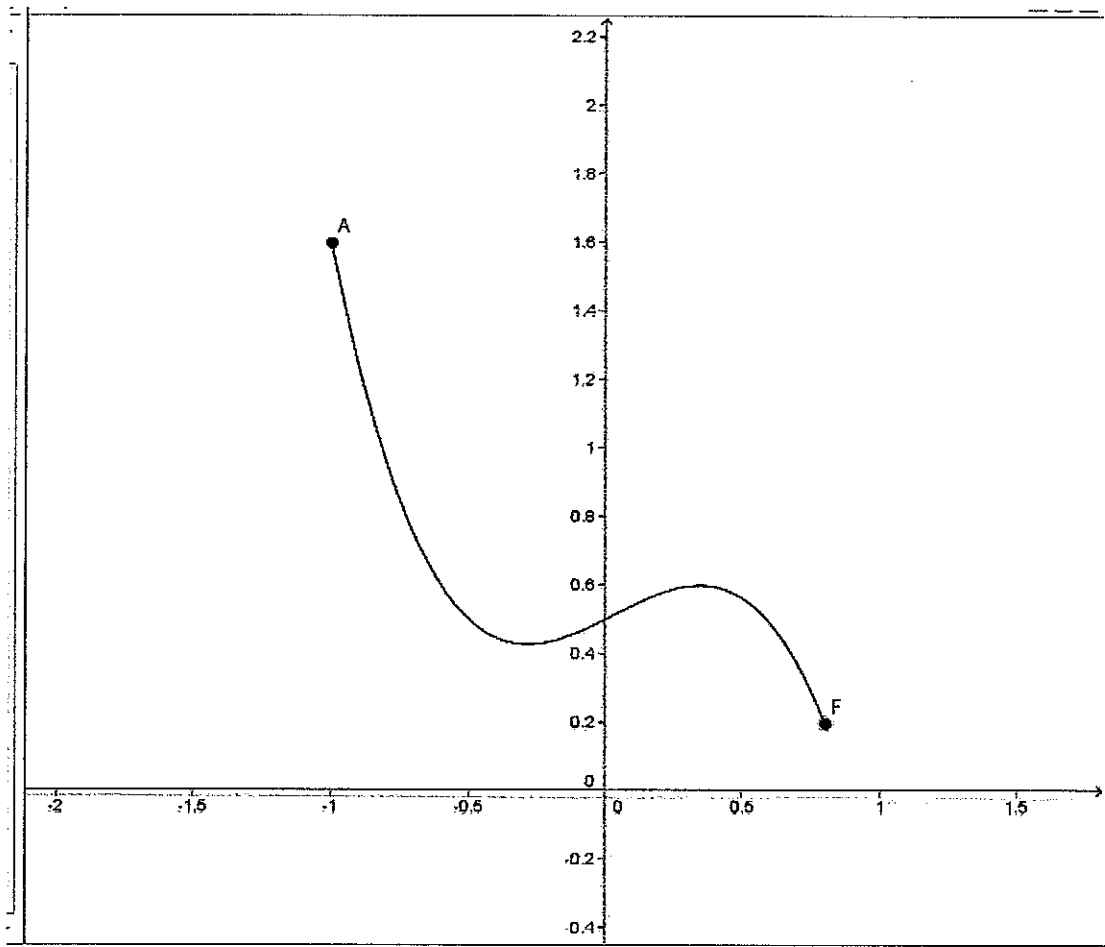


A (-1,1.6), C(1.39,0.2)

The quadratic equation of this line is $y = -0.49x^2 - 0.39x + 1.71$

The canopy is used for protection from sun light and light rain, the most advantage of a canopy chair.

Cubic equation of cubic line AF (Whole back of the chair)

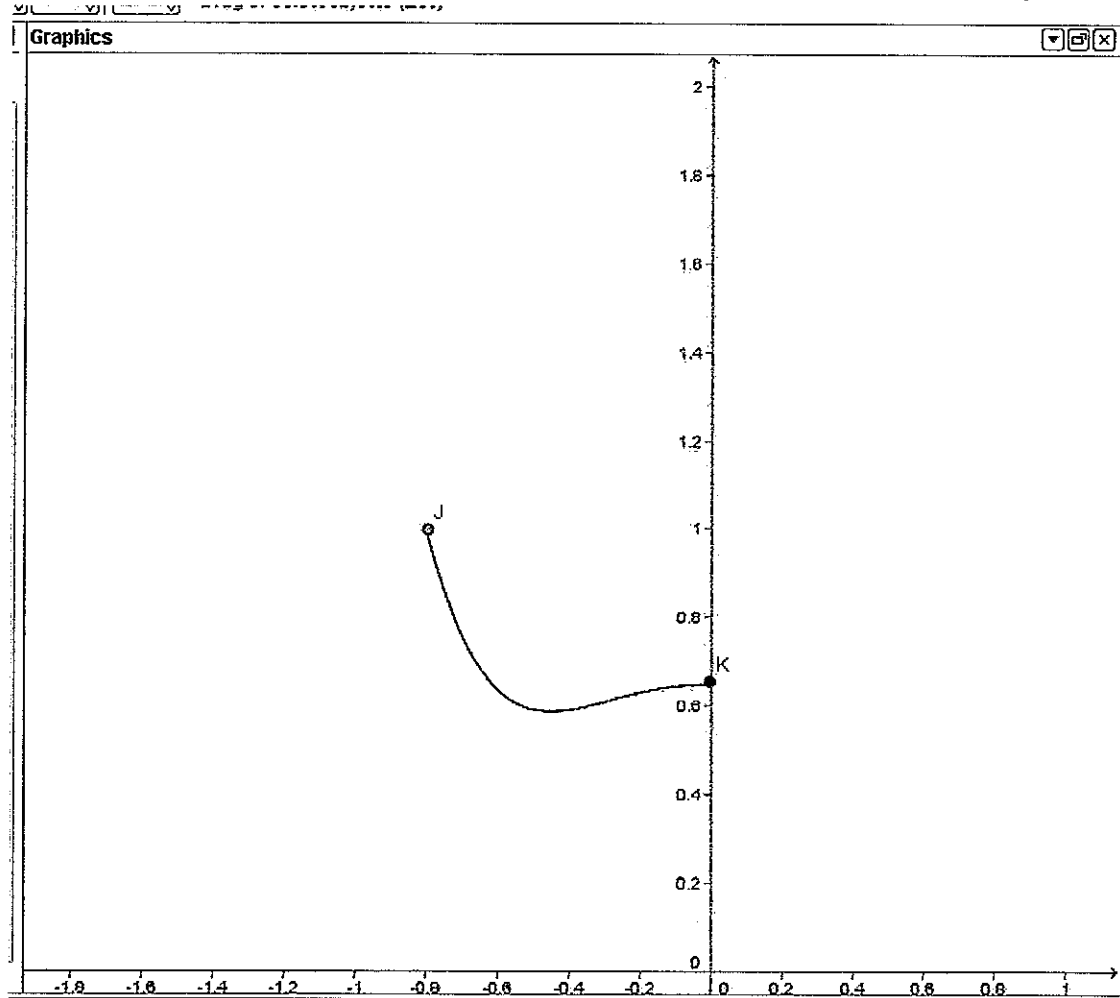


A (-1, 1.6), F (0.8, 0.2)

The cubic equation of this line is $y = -1.38x^3 + 0.13x^2 + 0.41x + 0.5$

This is the whole area of which the place where the person sits on, the sitting area is 40x40cm.

Quartic Equation of quartic line JK (armrest)

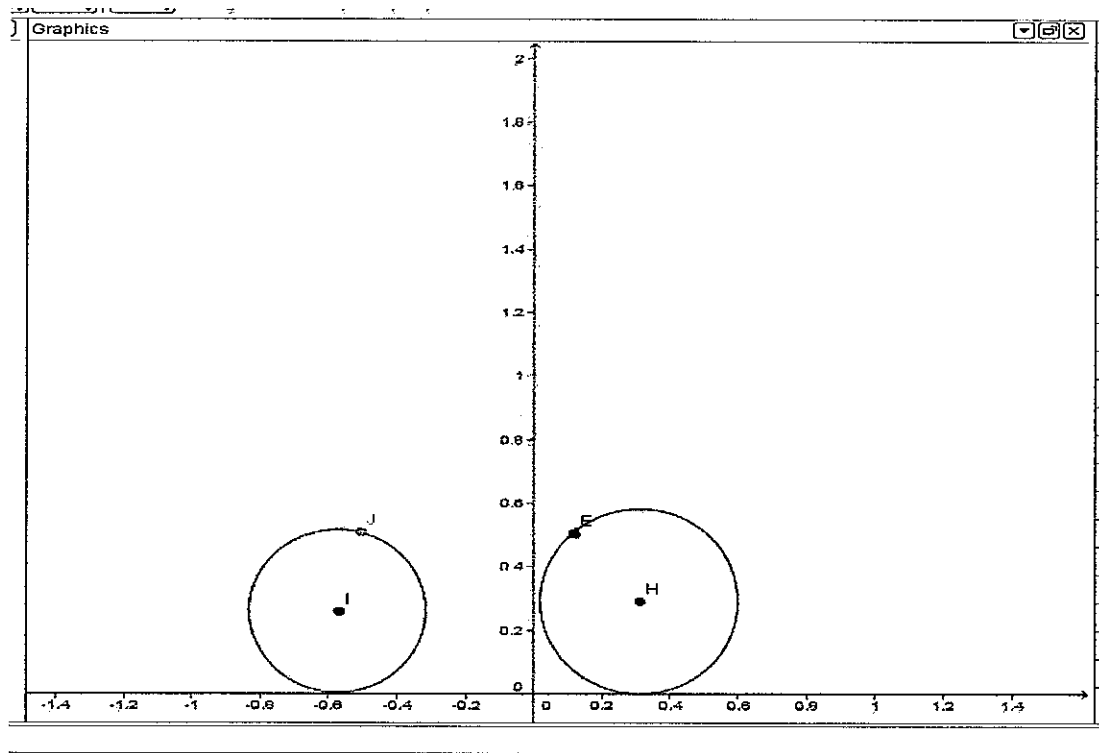


J (-0.8, 1), K (0, 0.66)

The quartic equation of this line is $y = 3(x-0.05)^4 + 2(x-0.05)^3 + 0.65$

The armrest is 60cm long because it can be the support of the whole hand.

The unfamiliar equation of circle of JI and EH(wheel of the chair)



J(-0.51,0.51), I(-0.57,0.26)

E(0.11,0.51), H(0.31,0.29)

The unfamiliar equation of JI is $y=(x+0.57)^2+(y-0.26)^2=0.07$

The unfamiliar equation of EH is $y=(x-0.31)^2+(y-0.29)^2=0.08$

The circles are used to move the chair so it can be move anytime, not to stick in a place.

Possible Modifications

Modifications I- I should've handed in the first draft of my design

I did this report in a very limited time, which I am lack of time, therefore I don't have any time to double check my work or to make it better. I also missed the chance to hand in the first draft to my teacher Mr. Davis, and it is very big mistake not to hand it in because I will miss a very important feedback which will guide me through the whole report.

Modifications II - The water front chair can be demonstrated in 3D instead of 2D

The design that I've made is only demonstrated in 2D, it can actually be demonstrated in 3D. There will be many differences between 3D and 2D, for example - there seems to have only two wheels in my chair, but there are actually four chairs because we can't see it when it is demonstrated in 2D.

Modifications III - The size of all my lines could have been changed

Due to the lack of time, my design could not be perfectly done; my design might not match all of the specifications. For example, the height of my chair could have been changed if it was too high or too low. I could have done more research on the size of people so I can have a more accurate size when I've made my design.



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